Patent Claims

1. Device for interferometric wavefront measurement of an optical system, having

- a detector arrangement (11) for positioning in the beam path downstream of the optical system (7) for detecting a generated interference pattern of a wavefront within a detection area, and
- a dynamic range correction element (12, 12a), for positioning in the beam path upstream of the detector arrangement, designed for keeping the variation in the spatially dependent characteristic of a phase of the wavefront forming the interference pattern below a prescribable limit value throughout the detection area.

2. Device according to Claim 1, wherein it is of the type operating with lateral shearing interferometry, and the dynamic range correction element is designed for keeping the second partial spatial derivatives of the phase of the wavefront forming the interference pattern below a prescribable threshold value throughout the detection area.

3. Device according to Claim 1, wherein the dynamic range correction element is selected from the group which comprises a computer-generated hologram element, another diffractive optical element and an aspheric lens element.

4. Device according to Claim 3, wherein there is provided for the dynamic range correction element and a diffraction grating structure a common transparent carrier (9) on whose front side the diffraction grating structure is arranged and on whose rear side the dynamic range correction element is arranged.

5. Device for wavefront measurement of an optical

system by means of lateral shearing interferometry, having

- at least one mask structure element (8, 8a) for positioning in the beam path upstream of the optical system,
- at least one diffraction structure element (9, 9a) with at least one periodic diffraction structure for positioning in the beam path downstream of the optical system, and
- a detector arrangement (11, 11a) for positioning in the beam path downstream of the diffraction structure element for detecting a generated interference pattern of a wavefront within a detection area,
- a set of several diffraction structures of different period lengths being provided on the diffraction structure element(s), and a set of corresponding mask structures being provided on the mask structure element(s), in order to measure the optical system with the aid of diffraction structures of different period lengths for at least two different subareas (P1, P2, P3) of the detection area.

6. Device according to Claim 5, wherein at least a first diffraction structure with a first period length is provided for measuring the optical system in a first detection subarea (P1), and a second diffraction structure with a second period length greater than the first period length is provided for measuring the optical system in a second detection subarea (P2) with a higher wavefront phase modulation than in the first detection subarea.

7. Device for wavefront measurement of an optical system by means of point diffraction interferometry, having

- a pinhole mask (34) for positioning in the beam

path upstream of the optical system,

- a beam splitting element (35) for generating a measuring beam and a reference beam,
- at least one detector-side shadow mask structure (38, 39, 40) for positioning in the beam path downstream of the optical system and having a reference pinhole (39) for the reference beam and a signal passage opening (40), spaced apart therefrom, for the measuring beam, and
- a detector arrangement (44) for positioning in the beam path downstream of the detector-side shadow mask structure for detecting a generated interference pattern within a detection area,
- a set of several pairs of reference pinhole (39) and signal passage opening (40) with different spacings of reference pinhole and signal passage opening being provided in order to measure the optical system with the aid of shadow mask structures with different spacings of reference pinhole and signal passage opening for at least two subareas (P1, P2, P3) of the detection area.

8. Device according to Claim 6 or 7, wherein an evaluation unit (13, 13a) is provided for evaluating the detected interference pattern including determination and correction of a distortion error.

9. Method for optical measurement of an optical system, wherein

- measuring radiation coming from the optical system is detected, and
- a distortion error is determined by determining a distortion function from a comparison of detected actual positions of interference fringes with computational desired positions when changing one or more external parameters, the change in the at least one external parameter comprising a change in the position of a detector arrangement or of a

mask structure of a measuring device parallel to a main optical axis, a change in the wavelength of the measuring radiation or a change in aberrations through adjustment of xy-manipulators or z-manipulators of the measured optical system, or several of these change measures.

10. Method for optical measurement of an optical system, wherein

- measuring radiation coming from the optical system is detected, and
- a distortion error of the detected measuring radiation is determined and corrected computationally,
- the distortion error being determined by calculating a distortion transformation by means of a calculation of the optical beam path or by a distortion measurement by means of introducing reference patterns into a pupil, or a plane near the pupil, of a measuring optical imaging system, or into a plane conjugate therewith, or by a distortion measurement by means of moiré structures or by determining a distortion function from a comparison of detected actual positions of interference fringes with computational desired positions when changing one or more external parameters, the change in the at least one external parameter comprising a change in the position of a detector arrangement or of a mask structure of a measuring device parallel to a main optical axis, a change in the wavelength of the measuring radiation or a change of aberrations by adjusting xy-manipulators or z-manipulators of the measured optical system or several of these change measures, and
- a distortion transformation describing the distortion error is determined by measurement and/or computationally, and the distortion error

is corrected computationally by applying the inverse distortion transformation.

11. Method according to Claim 9 or 10, wherein the optical measurement is carried out by means of a lateral shearing interferometry technique, a point diffraction interferometry technique or another interferometric wavefront measurement technique.

12. Method according to Claim 11, wherein the interferometric wavelength measurement comprises the following steps:

- placing a detector arrangement in the beam path downstream of the optical system in order to detect a generated interference pattern of a wavefront within a detection area, and
- placing a dynamic range correction element in the beam path upstream of the detector arrangement, which element is designed for keeping the variation in the spatially dependent characteristic of a phase of the wavefront forming the interference pattern below a prescribable limit value throughout the detection area.

13. Method according to Claim 11 or 12, wherein the interferometric wavefront measurement comprises a measurement by means of lateral shearing interferometry having the following steps:

- positioning at least one mask structure element in the beam path upstream of the optical system,
- positioning at least one diffraction structure element with at least one periodic diffraction structure in the beam path downstream of the optical system, and
- positioning a detector arrangement in the beam path downstream of the diffraction structure element in order to detect a generated interference pattern of a wavefront within a

detection area,

- a set of several diffraction structures of different period lengths being used on the diffraction structure element(s), and a set of corresponding mask structures being provided on the mask structure element(s), in order to measure the optical system with the aid of diffraction structures of different period lengths for at least two different subareas of the detection area.

14. Method according to Claim 11 or 12, wherein the interferometric wavefront measurement comprises a measurement by means of point diffraction interferometry having the following steps:

- positioning a pinhole mask in the beam path upstream of the optical system,
- positioning at least one detector-side shadow mask with at least one pair of a reference pinhole and a signal passage opening spaced apart therefrom in the beam path downstream of the optical system, and
- positioning a detector arrangement in the beam path downstream of the detector-side shadow mask in order to detect a generated interference pattern of a wavefront within a detection area,
- a set of several pairs of reference pinhole and signal passage opening with different spacings of reference pinhole and signal passage opening being used in order to measure the optical system with the aid of pairs of holes with a different spacing of reference pinhole and signal passage opening for at least two different subareas of the detection area.